Hydrological Summary for Great Britain

MAY 1993

Rainfall

Weather patterns during May were especially capricious and wide spatial variations in sunshine hours, temperatures and rainfall amounts occurred throughout Great Britain. Overall however, much of southern Britain was warmer than average and Scotland cooler. In parts of northern Britain significant snowfall occurred around mid-month. To the south, thundery activity was common in the latter half of May with some notable storm totals registered on the 25/26th - over 100 mm in a few locations in central southern England. Provisional regional rainfall totals for May were at or above average throughout GB and the nationwide total was the highest for May since 1986. Northern Britain was especially wet; by contrast some districts in southern and eastern England missed the more vigorous thunderstorms and registered less than 80% of average. Regional rainfall totals are now close to the 1941-70 average for the year thus far and generally above average, albeit modestly, in the 12-month timeframe. A few areas have remained relatively dry and the vestiges of the meteorological drought persist - for example in localities adjacent to the Thames Estuary. Generally though, the drought has declined to a very minor intensity relative to its extreme severity in the late winter of 1991/92.

River Flows

A dry, warm spell in late April/early May signalled the beginning of the summer recessions in many lowland rivers as accelerating evaporation rates and drying soils reduced the hydrological effectiveness of the late-spring rainfall. Nonetheless, localised flooding occurred in a number of lowland rivers in response to torrential (but spatially restricted) rainfall on the 25/26th. Spate conditions were more widespread in northern Britain where some notable peak flows were reported around mid-month. Maximum river levels on the Derwent and the Browney in Northumbria were similar to the previous highest on record and existing peak flows for May were widely eclipsed in Scotland - for example on the Tay, Tweed and Dee, the latter by a very wide margin. Bankfull discharge rates were common and localised flooding characterised many areas (including Edinburgh). Runoff totals for May were generally above average in northern and western Britain. Mean flows in the English lowlands were well within the normal range - typically below average but markedly greater than a year ago. The post-drought recovery is usefully exemplified on the River Lee where naturalised flows were around twice those of May 1992. Further confirmation of the improvement in the hydrological situation is furnished by the accumulated runoff totals since the beginning of the water-year (October 1992). Generally, these are indicative of normal conditions and are typically between two and four times of the corresponding runoff for 1991/92 in the lowlands.

Groundwater

Heavy May rainfall in a few lowland areas resulted in some localised groundwater replenishment (e.g. in the Berkshire Downs); recharge was generally more significant in western areas. The wet late spring period moderated - and in a few areas reversed - the 1993 recessions and groundwater levels are now well within the normal range in most areas. Index wells in the Chalk confirm that early summer levels are mostly at their highest for five years. The Permo-Triassic sandstones continue to present a more uneven picture but belated recoveries can now be identified in most wells where early spring levels were exceptionally low - these include the Weeford Flats borehole, which prior to May had been dry for two years. Water-tables are still depressed in a few districts - the spatial extent of these pockets, where the groundwater outlook will remain fragile into next winter's recharge season - will be easier to define once the response to the limited recent recharge has been registered.

General

The late May rainfall was usefully timed to forestall surges in demand (arising largely from irrigation and gardening needs) and top-up already healthy reservoir stocks. Except in a few localities where water resources will still need to be monitored carefully, the outlook is more encouraging in the early summer than in any year since 1988.

Institute of Hydrology

British Geological Survey

Data for this report have been provided principally by the regional divisions of the National Rivers Authority in England and Wales, the River Purification Boards in Scotland and by the Meteorological Office. Reservoir contents information has been supplied by the Water Services Companies, the NRA or, in Scotland, the Lothians Regional Council. The most recent areal rainfall figures are derived from a restricted network of raingauges (particularly in Scotland) and a proportion of the river flow data is of a provisional nature.

A map (Figure 3) is provided to assist in the location of the principal monitoring sites.

13 May 1993

Institute of Hydrology/British Geological Survey
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB

TABLE 1 1992/93 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		May	June	July	Aug	Sept	Oct	Nov	Dec	Jan 1993	Feb	Mar	Apr	May
England and Wales	mm	49	38	83	129	92	90	135	75	98	18	27	96	86
	%	73	62	114	143	111	108	139	84	114	28	46	166	129
NRA REGIONS														
North West	mm	62	30	79	151	110	128	163	107	135	22	34	113	125
	%	76	36	77	121	89	109	135	89	120	28	47	147	152
Northumbria	mm	31	19	63	99	95	84	99	69	78	17	24	119	109
	%	48	31	82	98	120	112	105	92	98	26	46	216	170
Severn-Trent	mm	60	54	88	120	74	73	111	60	77	10	16	77	78
	%	94	96	135	148	110	113	141	85	112	19	31	149	123
Yorkshire	mm	34	33	81	99	95	80	104	67	82	22	17	107	82
	%	56	57	116	110	132	115	116	90	107	34	32	191	135
Anglian	mm	48	34	89	83	86	72	86	40	54	17	17	69	52
	%	102	69	156	130	165	138	140	75	105	40	42	172	110
Thames	mm	59	39	78	107	93	76	112	57	82	6	24	78	58
	%	105	75	130	153	150	118	153	86	132	13	53	169	103
Southern	mm	29	26	75	104	70	81	132	70	85	9	31	85	57
	%	53	52	127	143	99	103	141	87	112	16	60	176	103
Wessex	mm	25	50	64	129	85	50	149	82	120	7	40	81	68
	%	37	93	103	157	108	61	153	91	143	12	69	150	100
South West	mm%	30	23	83	174	93	96	197	104	152	22	35	99	125
		36	35	99	173	89	85	147	77	118	25	42	139	149
Welsh	mm	70	51	93	222	114	100	196	124	168	23	31	105	128
	%	77	62	98	187	91	77	137	85	123	24	35	122	141
Scotland	mm	80	40	91	221	177	148	196	141	291	70	91	128	132
	%	88	43	81	171	129	99	138	90	212	67	98	142	145
RIVER PURIFICATION BOARDS														
Highland	mm	108	46	95	255	214	144	241	190	407	86	107	95	176
	%	105	42	75	172	135	78	143	101	248	65	94	84	171
North-East	mm	57	52	47	132	107	107	97	90	200	41	56	64	116
	%	74	74	51	123	123	110	94	88	220	55	90	105	151
Tay	mm	57	31	77	201	160	92	165	106	324	32	83	109	146
	%	60	37	75	170	139	76	153	79	274	35	102	145	154
Forth	mm	49	25	74	183	166	80	167	81	236	18	76	122	141
	%	58	33	75	158	154	75	155	74	238	24	111	180	168
Tweed	mm	49	27	61	157	118	80	123	75	139	13	42	119	121
	%	65	40	69	138	127	91	118	83	149	18	73	195	159
Solway	mm	63	30	101	215	155	114	190	119	200	22	87	158	151
	%	69	33	92	165	103	79	131	79	143	23	95	179	164
Clyde	mm	95	39	123	278	205	135	272	142	332	42	137	178	146
	%	98	38	95	196	117	74	163	76	206	37	130	173	151

Note: The most recent monthly rainfall figures correspond to the MORECS areal assessments derived by the Meteorological Office; the provisional figures for England and Wales and for Scotland are derived using a different raingauge network. The regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.

TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

		Jan-May93		Jun92-May93		Mar90-May93		Aug88-May93	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm%	325		967		2622		4044	
	LTA	97	2-5	106	2-5	90	5-15	91	10-20
NRA REGIONS									
North West	mm%	429		1198		3632		5658	
	LTA	101	2-5	98	2-5	94	5	96	2-5
Northumbria	mm	348		876		2619		3835	
	% LTA	110	2-5	100	<2	93	5	90	10-20
Severn-Trent	mm	259		839		2223		3412	
	% LTA	89	2-5	109	2-5	89	5-15	91	5-15
Yorkshire	mm	310		868		2368		3594	
	% LTA	100	<2	104	2-5	89	10-20	89	15-25
Anglian	mm	208		697		1728		2585	
	% LTA	94	2-5	114	5-10	88	10-20	88	20-35
Thames	mm	248		810		1989		3049	
	% LTA	97	2-5	115	5-10	88	10-20	90	10-20
Southern	mm	267		825		2193		3344	
	% LTA	93	2-5	104	2-5	86	15-25	87	25-40
Wessex	mm	315		923		2380		3757	
	% LTA	98	2-5	106	2-5	85	20-35	89	10-20
South West	mm	434		1204		3356		5361	
	% LTA	95	2-5	101	2-5	88	10-20	92	5-10
Welsh	mm	454		1354		3865		6122	
	% LTA	91	2-5	102	2-5	91	5-10	94	5
Scotland	mm	712		1726		5281		8061	
	% LTA	139	70-110	121	30-40	116	150-200	116	>>200
RIVER PURIFICATION BOARDS									
Highland	mm	871		2056		6562		10098	
	% LTA	139	50-80	119	15-25	119	>200	121	>>200
North-East	mm	477		1108		3199		4650	
	% LTA	131	15-25	108	2-5	98	2-5	94	5-10
Tay	mm	694		1526		4339		6703	
	% LTA	150	80-120	122	10-20	108	5-10	110	10-20
Forth	mm	594		1370		3952		5989	
	% LTA	150	120-180	123	20-35	111	10-20	111	20-30
Tweed	mm	433		1074		3240		4761	
	% LTA	121	5-10	107	2-5	101	2-5	98	2-5
Solway	mm	617		1541		4762		7341	
	% LTA	122	5-10	108	2-5	105	2-5	106	5-10
Clyde	mm	835		2029		6399		9769	
	% LTA	144	80-120	122	25-40	121	>>200	121	>>200

Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less - for the longest durations the return period estimates converge. "Wet" return periods underlined.

* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Jan 1993	Feb	Mar	Apr	May 1993		1/93 to 4/93		5/92 to 4/93		5/90 to 4/93		11/88 to 4/93	
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at Park	155 175	75 104	66 71	97 124	87 142	17 /21	479 121	20 /21	710 109	16 /20	2262 93	6 /18	3298 88	2 /17
Tay at Ballathie	327 226	111 97	97 76	168 196	80 116	30 /41	782 143	39 /41	1198 130	38 /41	3852 111	31 /38	6258 118	35 /37
Whiteadder Water at Hutton Castle	53 91	20 42	14 28	50 131	63 241	23 /24	201 91	9 /24	326 99	11 /24	1134 94	8 /21	1479 78	5 /20
South Tyne at Haydon Bridge	152 157	22 30	24 28	101 182	84 241	30 /31	384 111	22 /31	649 107	21 /31	2262 97	12 /25	3372 93	5 /23
Wharfe at Flint Mill Weir	132 135	27 36	20 26	60 110	63 169	31 /38	301 88	14 /38	552 95	19 /38	1906 86	5 /35	2940 86	2 /34
Derwent at Buttercrambe	32 71	18 46	20 49	35 112	25 107	22 /32	131 74	7 /32	235 88	11 /32	721 72	3 /29	1024 65	1 /28
Trent at Colwick	46 93	18 43	14 35	29 91	19 77	13 /35	125 67	4 /35	272 96	17 /35	828 76	2 /32	1323 78	1 /31
Lud at Louth	30 105	19 58	17 50	19 62	17 66	8 /25	102 68	8 /25	154 79	9 /25	408 53	2 /22	644 54	1 /21
Witham at Claypole Mill	32 128	37 143	13 51	15 73	11 72	17 /35	109 97	16 /34	199 130	25 /34	440 78	8 /32	668 76	4 /30
Little Ouse at Abbey Heath	25 112	14 66	16 75	14 79	10 70	9 /26	80 83	7 /25	126 93	12 /25	304 59	2 /23	517 65	1 /21
Colne at Lexden	29 131	9 50	8 45	11 85	6 70	13 /34	62 78	9 /34	133 114	26 /34	278 68	3 /31	475 73	1 /30
Lee at Feildes Weir (natr.)	28 130	13 66	12 62	24 161	11 86	46 /108	88 99	58 /107	152 117	74 /107	322 65	8 /102	554 72	10 /99
Thames at Kingston (natr.)	55 150	24 73	16 52	31 138	17 98	67 /111	143 102	61 /111	266 130	89 /110	589 78	18 /108	952 81	12 /106
Coln at Bibury	80 159	58 110	36 68	34 80	29 89	10 /30	236 102	12 /30	396 127	28 /30	1017 84	8 /27	1587 85	4 /26
Great Stour at Horton	41 104	21 64	18 55	21 82	14 67	6 /29	114 76	6 /28	221 95	15 /27	641 72	3 /23	950 69	1 /19
Itchen at Highbridge+Allbrook	59 125	49 102	44 86	46 100	41 98	14 /35	239 102	17 /35	345 102	21 /35	1108 78	2 /32	1709 80	1 /31
Piddle at Baggs Mill	86 169	53 92	35 63	38 90	29 92	14 /30	242 102	16 /29	369 113	22 /29	1019 82	5 /24	1583 81	3 /21
Tone at Bishops Hull	90 115	29 40	18 32	34 89	19 71	7 /33	189 70	5 /32	359 89	10 /32	1022 71	1 /30	1768 77	1 /28
Severn at Bewdley	71 100	21 37	12 26	26 82	25 107	49 /73	154 67	9 /72	330 87	20 /72	1105 80	7 /70	1803 84	3 /68
Cynon at Abercynon	299 157	38 28	23 19	114 148	67 115	23 /35	541 93	13 /35	1166 112	26 /35	3616 94	13 /29	5816 98	14 /27
Dee at New Inn	275 117	30 18	36 20	138 130	139 211	21 /24	618 82	7 /24	1275 89	8 /24	4777 87	3 /21	7545 88	1 /20
Eden at Sheepmount	157 155	30 40	26 37	79 168	66 205	21 /23	358 110	16 /23	626 109	14 /22	2120 102	10 17	3299 102	7 /14
Clyde at Daldowie	197 183	37 49	52 68	89 199	76 218	28 /30	451 131	28 /30	796 128	27 /30	2844 120	26 27	4310 119	26 /26

Notes:
(i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked so that lowest runoff as rank 1.
(iii) %LT means percentage of long term average from the start of the record to 1992. For the long periods (at the right of this table), the end date for the long term is 1993.

TABLE 4 START-MONTH RESERVOIR STORAGES UP TO JUNE 1993

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1993 Jan	Feb	Mar	Apr	May	June	1992 June
North West	Northern Command Zone[1]	(G)	133375	88	98	84	77	91	92	86
	Vyrnwy	(R)	55146	89	86	87	78	87	94	94
Northumbria	Teesdale[2]	(G)	87936	90	98	91	83	95	96	89
	Kielder	(R)	199175*	74*	90*	81*	81*	91*	96*	90*
Severn-Trent	Clywedog	(R)	44922	84	96	87	87	95	100	97
	Derwent Valley[3]	(G)	39525	88	99	91	73	81	90	91
Yorkshire	Washburn[4]	(G)	22035	95	99	92	83	91	94	95
	Bradford supply[5]	(G)	41407	94	100	89	76	83	91	91
Anglian	Grafham	(R)	58707	94	96	93	92	93	95	96
	Rutland	(R)	130061	95	93	93	88	94	93	82
Thames	London[6]	(G)	206232	96	96	93	91	95	96	93
	Farmoor [7]	(G)	13843	96	92	96	95	99	98	98
Southern	Bewl	(R)	28170	82	91	91	91	97	96	73
	Ardingly	(R)	4685	100	100	100	100	100	100	100
Wessex	Clatworthy	(R)	5364*	100	100	94	83	86	86	77
	Bristol WW [8]	(G)	38666*	94*	97*	93*	85*	89*	84*	80*
South West	Colliford	(R)	28540	82	88	88	83	83	84	80
	Roadford	(R)	34500	90	92	83	80	78	78	91
	Wimbleball[9]	(R)	21320	90	100	99	91	92	89	76
	Stithians	(R)	5205	100	100	98	88	83	91	69
Welsh	Celyn + Brenig	(G)	131155	96	100	96	90	95	99	100
	Brianne	(R)	62140	99	100	96	90	99	100	97
	Big Five[10]	(G)	69762	94	99	91	78	89	92	93
	Elan Valley[11]	(G)	99106	98	100	88	89	98	100	96
Lothian	Edinburgh/Mid Lothian	(G)	97639	98	100	95	93	99	99	98
	West Lothian	(G)	5613	98	99	91	92	100	99	76
	East Lothian	(G)	10206	100	100	99	97	100	100	91

● Live or usable capacity (unless indicated otherwise)

* Gross storage/percentage of gross storage

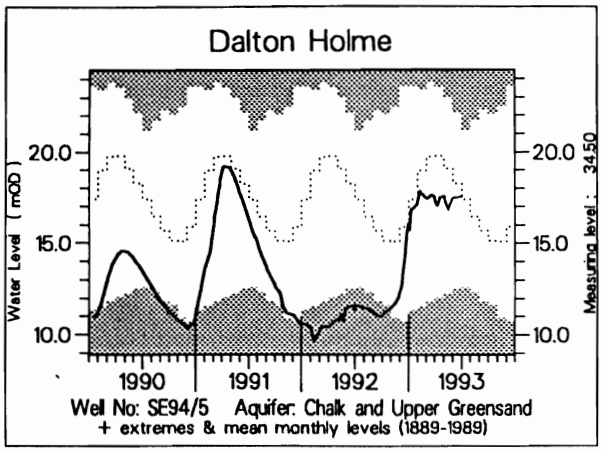
† Intake closure for engineering works caused storage to be lower than it would have been otherwise

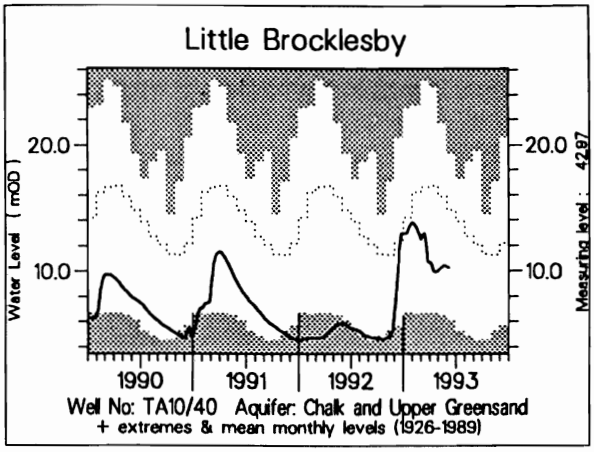
Kielder drawn down for ecological management

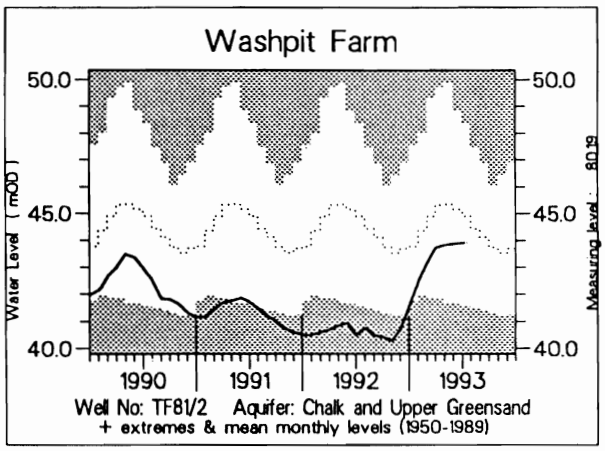
1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower.
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. Lower Thames (includes Queen Mother, Wraysbury, Queen Mary, King George VI and Queen Elizabeth II) and Lee Valley (includes King George and William Girling) groups - pumped storages.
7. Farmoor 1 and 2 - pumped storages.
8. Blagdon, Chew Valley and others.
9. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
10. Usk, Talybont, Llandegfedd (pumped storage), Taf Fechan, Taf Fawr.
11. Claerwen, Caban Coch, Pen y Garreg and Craig Goch.

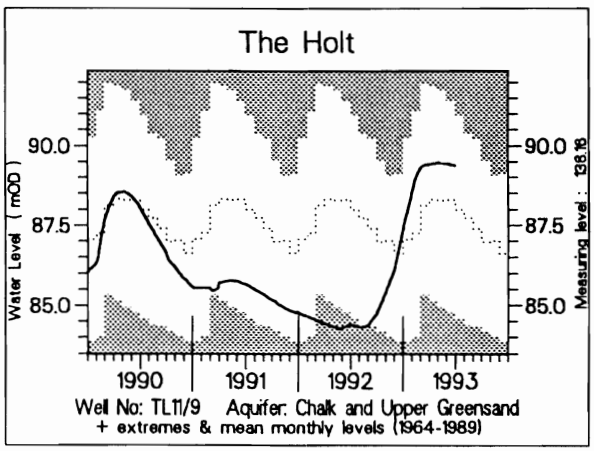
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 provides a link between the hydrological conditions described elsewhere in the report and the water resources situation.

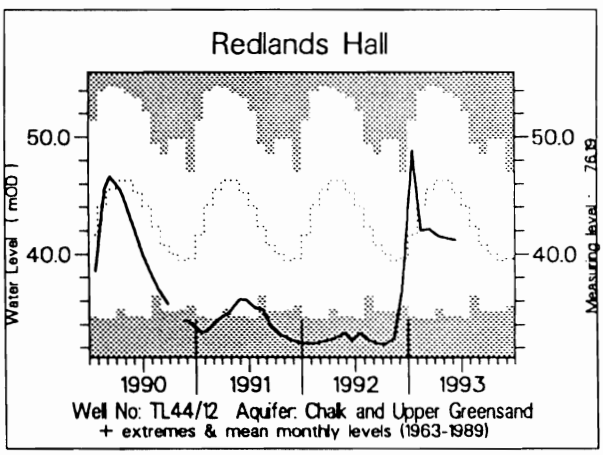
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

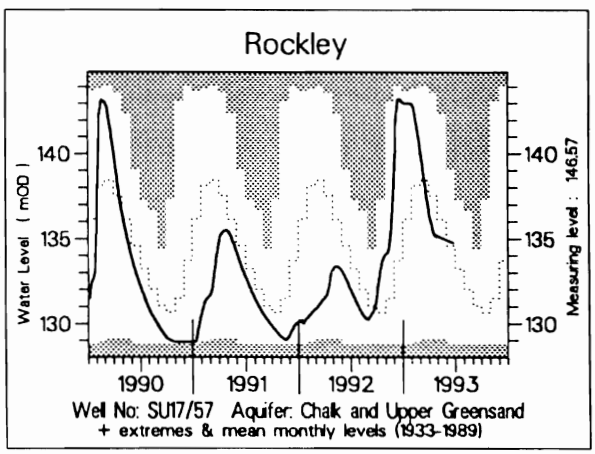


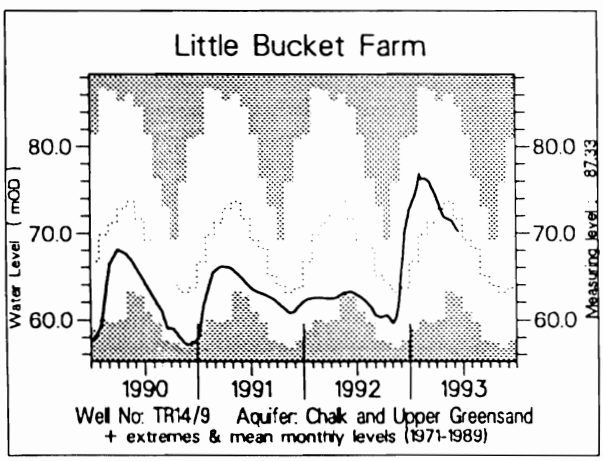


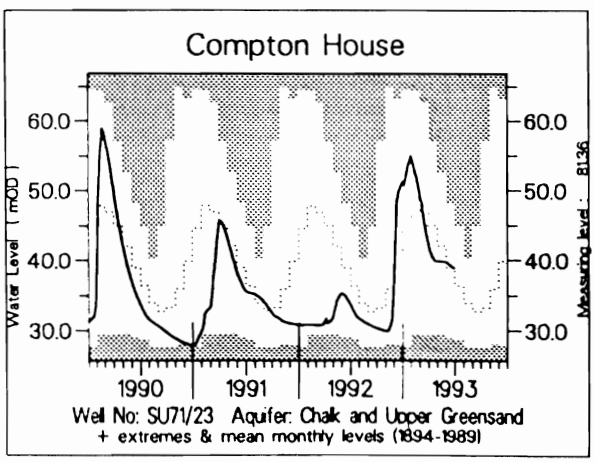


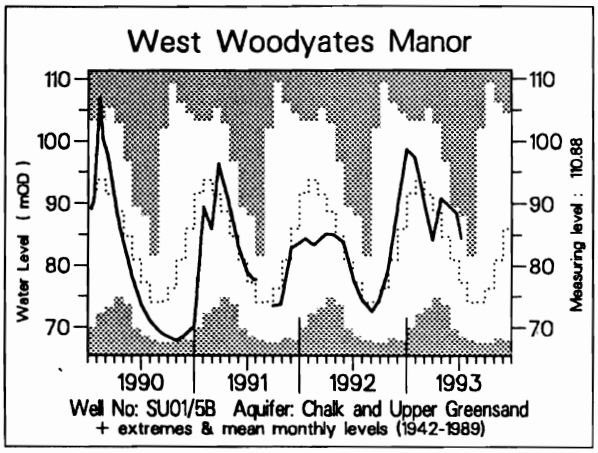


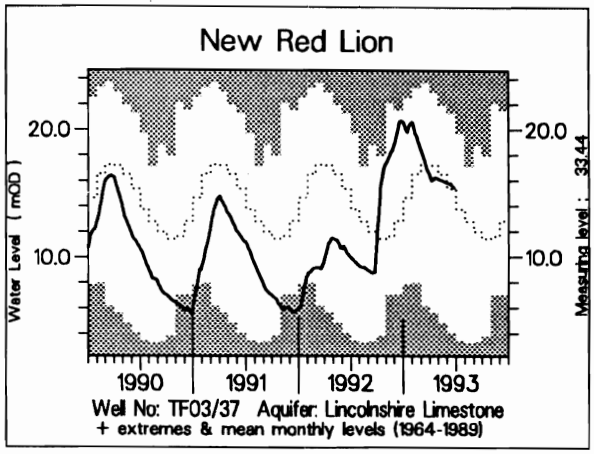


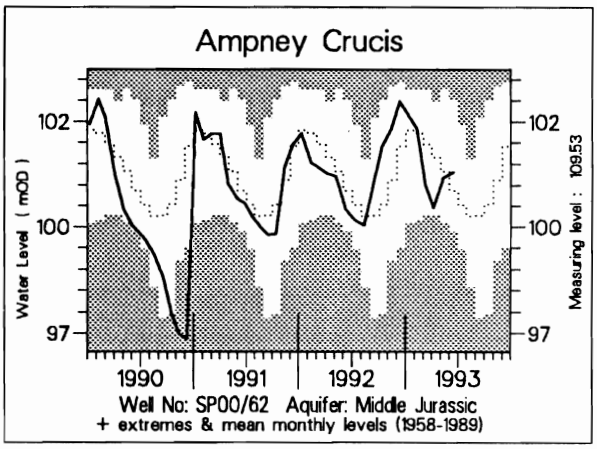


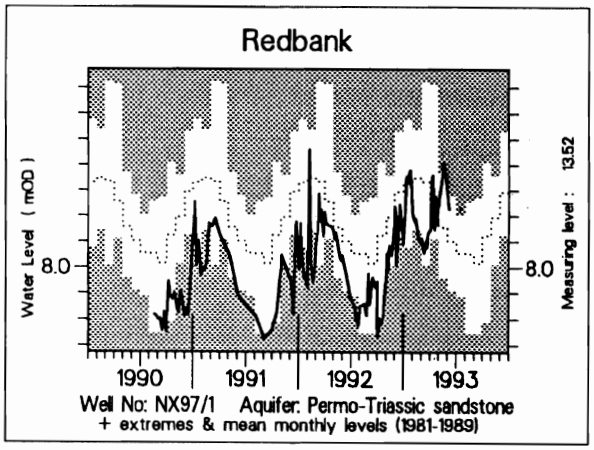


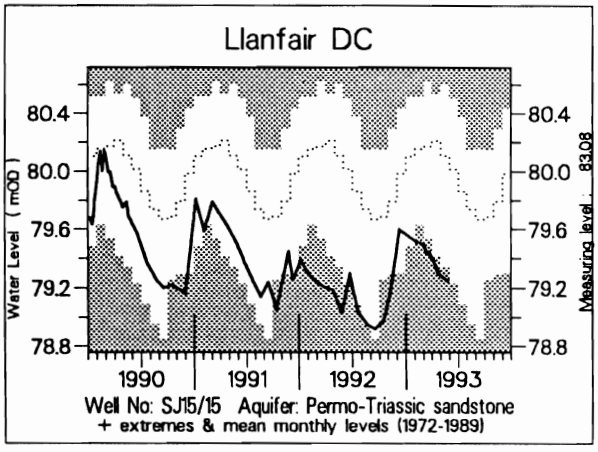


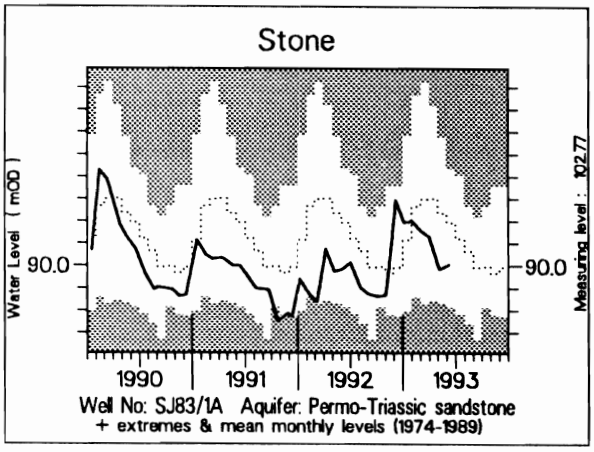

West Woodyates Manor
Water Level (mOD)
110
100
90
80
70
Measuring level : 110.88
1990
1991
1992
1993
Well No: SU01/5B Aquifer: Chalk and Upper Greensand
+ extremes & mean monthly levels (1942-1989)

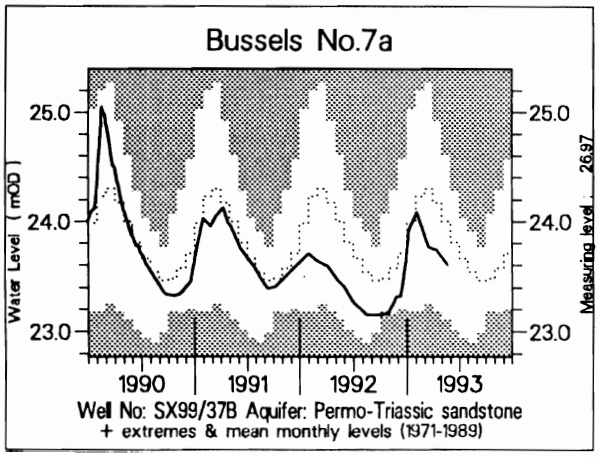

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.44
1990
1991
1992
1993
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1989)


Ampney Crucis
Water Level (mOD)
102
100
97
Measuring level : 109.53
1990
1991
1992
1993
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1989)


Redbank
Water Level (mOD)
8.0
Measuring level : 13.52
1990
1991
1992
1993
Well No: NX97/1 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1981-1989)


Llanfair DC
Water Level (mOD)
80.4
80.0
79.6
79.2
78.8
Measuring level : 83.08
1990
1991
1992
1993
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1989)


Stone
Water Level (mOD)
90.0
Measuring level : 102.77
1990
1991
1992
1993
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1989)


Bussels No.7a
Water Level (mOD)
25.0
24.0
23.0
Measuring level : 26.97
1990
1991
1992
1993
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1989)

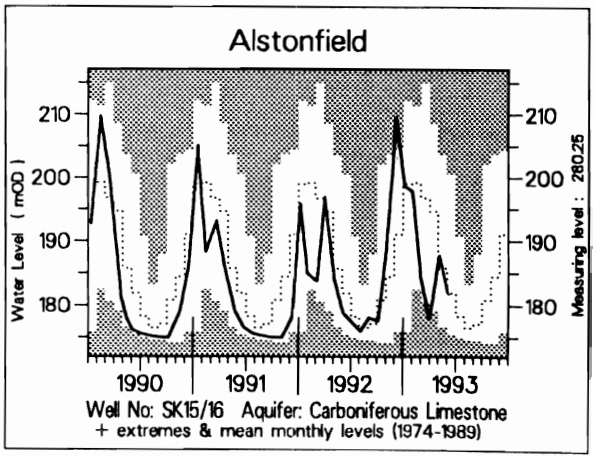

Alstonfield
Water Level (mOD)
210
200
190
180
Measuring level : 280.25
1990
1991
1992
1993
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1989)

TABLE 5 A COMPARISON OF MAY GROUNDWATER LEVELS: 1992 AND 1993

Site	Aquifer	Records commence	Average May level	May 1992		May/June 1993		No of years May level <1993	Least pre-1993 level
				day	level	day	level		any month
Wetwang	C & UGS	1971	23.51	29/05	19.78	28/05	23.06	4	16.66
Dalton Holme	C & UGS	1889	19.00	29/05	11.40	28/05	17.49	>10	9.64
Little Brocklesby	C & UGS	1926	14.65	26/05	5.84	24/05	10.23	6	4.53
Washpit Farm	C & UGS	1950	45.16	05/05	40.87	03/06	43.91	10	40.32
The Holt	C & UGS	1964	88.24	24/05	84.26	30/05	89.38	>10	83.90
Therfield Rectory	C & UGS	1883	81.76	31/05	72.03	01/06	80.38	>10	dry <71.6
Redlands Hall	C & UGS	1964	45.13	28/05	33.34	14/05	41.10	6	32.29
Rockley	C & UGS	1933	136.05	31/05	133.18	30/05	134.84	>10	dry <128.9
Little Bucket Farm	C & UGS	1971	71.26	20/05	63.10	20/05	70.18	8	56.77
Compton House	C & UGS	1894	42.07	27/05	35.24	02/06	39.16	>10	27.64
Chilgrove House	C & UGS	1836	50.02	27/05	46.06	02/06	47.56	>10	33.46
West Dean No 3	C & UGS	1940	1.87	29/05	1.50	28/05	1.87	>10	1.01
Lime Kiln Way	C & UGS	1969	125.43	22/05	124.02	18/05	124.38	1	123.70
Ashton Farm	C & UGS	1974	68.70	27/05	67.90	07/06	67.61	3	63.10
West Woodyates	C & UGS	1942	84.56	27/05	83.80	07/06	84.54	>10	67.62
New Red Lion	LLst	1964	15.99	28/05	10.68	24/05	15.38	>10	3.29
Ampney Crucis	Mid Jur	1958	101.29	07/05	101.21	09/06	101.11	>10	97.38
Yew Tree Farm	PTS	1973	13.54	31/05	13.28	24/05	13.56	7	8.43
Llanfair DC	PTS	1972	79.95	26/05	79.03	23/05	79.25	1	78.85
Morris Dancers	PTS	1969	32.51	08/05	32.02	18/05	31.85	0	30.87
Stone	PTS	1974	90.54	08/05	89.95	04/06	90.03	4	89.34
Skirwith	PTS	1978	130.57	no	levels	28/05	130.49	2	129.44
Redbank	PTS	1981	8.28	29/05	8.05	31/05	8.50	5	7.45
Bussels 7A	PTS	1972	23.97	05/05	23.48	12/05	23.60	3	22.90
Rushyford NE	MgLst	1967	72.45	31/05	74.76	05/05	75.25	4	64.77
Peggy Ellerton	MgLst	1968	34.58	11/05	31.79	10/05	31.97	2	31.10
Alstonfield	CLst	1974	186.37	04/05	184.39	04/06	181.67	8	174.22

groundwater levels are in metres above Ordnance Datum

C & UGS	Chalk and Upper Greensand	Mid Jur	Middle Jurassic limestones
LLst	Lincolnshire Limestone	MgLst	Magnesian Limestone
PTS	Permo-Triassic sandstones	CLst	Carboniferous Limestone

FIGURE 3 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS